Advanced Research Projects Agency • ENERGY

ELECTROFUELS PROJECT

UCLA

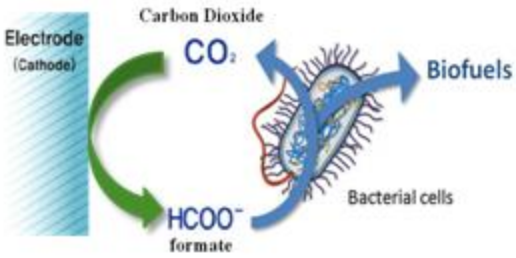
LIQUID FUEL FROM RENEWABLE ELECTRICITY AND BACTERIA

PROJECT TITLE:	Electro-Autotrophic Synthesis of Higher Alcohols		
ORGANIZATION:	University of California Los Angeles (UCLA)	LOCATION:	Los Angeles, CA
PROGRAM:	Electrofuels	ARPA-E AWARD:	$4,000,000
TECH TOPIC:	Advanced Fuels	PROJECT TERM:	7/1/10 – 6/30/13
WEBSITE:	www.arpa-e.energy.gov/ProgramsProjects/Electrofuels.aspx		

CRITICAL NEED

Domestic biofuels are an attractive alternative to petroleum-based transportation fuels. Biofuels are produced from plant matter, such as sugars, oils, and biomass. This plant matter is created by photosynthesis, a process that converts solar energy into stored chemical energy in plants. However, photosynthesis is an inefficient way to transfer energy from the sun to a plant and then to biofuel. Electrofuels—which bypass photosynthesis by using self-reliant microorganisms that can directly use the energy from electricity and chemical compounds to produce liquid fuels—are an innovative step forward.

PROJECT INNOVATION + ADVANTAGES



UCLA is utilizing renewable electricity to power direct liquid fuel production in genetically engineered Ralstonia eutropha bacteria. UCLA is using renewable electricity to convert carbon dioxide into formic acid, a liquid soluble compound that delivers both carbon and energy to the bacteria. The bacteria are genetically engineered to convert the formic acid into liquid fuel—in this case alcohols such as butanol. The electricity required for the process can be generated from sunlight, wind, or other renewable energy sources. In fact, UCLA's electricity-to-fuel system could be a more efficient way to utilize these renewable energy sources considering the energy density of liquid fuel is much higher than the energy density of other renewable energy storage options, such as batteries.

IMPACT

If successful, UCLA would create a liquid transportation fuel that is cost competitive with traditional gasoline-based fuels and more efficient than existing biofuels.

- SECURITY: Cost-competitive Electrofuels would help reduce U.S. dependence on imported oil and increase the nation's energy security.
- ENVIRONMENT: Widespread use of Electrofuels would help limit greenhouse gas emissions and reduce demands for land, water, and fertilizer traditionally required to produce biofuels.
- ECONOMY: A domestic Electrofuels industry could contribute tens of billions of dollars to the nation's economy. Widespread use of Electrofuels could also help stabilize gasoline prices—saving drivers money at the pump.
- JOBS: Electrofuels could create jobs in fuel production, distribution, and sales.

CONTACTS

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